AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.3.1.4

Chemical measurements

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**15**
Available paper years	**2008–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.3.1.4 Chemical measurements

Answer 01 · Mark scheme March 2008 | CHY1AP | Original Q5 | Legacy

Five	**1**	**3**	**1**	**1**

Answer 02 · Mark scheme June 2008 | CHY1BP | Original Q4 | Legacy

Four	**2**	**3**	**4**	**3**

Answer 03 · Mark scheme November 2008 | CHY1BP | Original Q5 | Legacy

Five	**1**	**4**	**4**	**2**

Answer 04 · Mark scheme March 2009 | CHY1AP | Original Q5 | Legacy

Five	**2**	**4**	**3**	**3**

4.3.1.4 Chemical measurements

Answer 05 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)	the ions can <u>move</u> / <u>travel</u> / <u>flow</u> / are <u>free</u> **or** the ions <u>carry</u> the charge / current	accept particles / they for ions allow delocalised ions ignore delocalised / free electrons ignore references to collisions accept converse with reference to solid ignore ions carry electricity	1
1(b)	any **one** from: • because they are negative / anion • opposite charges / attract	allow Cl^- ignore chlorine	1
1(c)	13		1
1(d)(i)	reasonable attempt at straight line which misses the anomalous point	must touch all five crosses do **not** allow multiple lines	1
1(d)(ii)	40	ignore 2.2	1

Question 1 continues on the next page

CHY2H

Question 1 contd

question	answers	extra information	mark
1(d)(iii)	any **two** sensible errors from: • gas escapes • weighing error • error in measuring (volume / amount) of hydrogen • error in measuring (volume / amount) of water • incorrect concentration • timing error • change in voltage / current • change in temperature • recording / plotting error	ignore systematic / human / apparatus / zero /experimental / random / measurement / reading errors unless qualified allow NaCl not measured correctly allow error in measuring volume / scale for **1** mark if neither hydrogen or water mentioned allow NaCl not fully dissolved **or** spilled **or** impure allow faulty power supply	2
1(d)(iv)	any **one** from: • repeat the experiment • results compared with results from /other students / other groups / other laboratories / internet / literature. • results compared with another method	ignore 'do more tests'	1
1(d)(v)	increases owtte	allow directly proportional or positive correlation allow rate / it is faster / quicker	1
Total			**9**

4.3.1.4 Chemical measurements

Answer 05 · Mark scheme

January 2011 | CHY2H | Original Q1 | Legacy

CHY2H

4.3.1.4 Chemical measurements

Answer 06 · Mark scheme

June 2011 | CHY2H | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	because they are gases	ignore vapours / evaporate / (g) allow it is a gas	1
2(b)(i)	80 / 79.5	correct answer with or without working = **2** marks ignore units if no answer **or** incorrect answer then evidence of 64 / 63.5 + 16 gains **1** mark	2
2(b)(ii)	80 / 79.87 / 79.9 / 79.375 / 79.38 / 79.4	correct answer with or without working = **2** marks if no answer **or** incorrect answer then evidence of $\frac{64}{80}$ **or** $\frac{63.5}{79.5}$ (x100) gains **1** mark accept (ecf) $\frac{64 or 63.5}{answer(b)(i)}(\times 100)$ for **2** marks if correctly calculated. if incorrectly calculated evidence of $\frac{64 or 63.5}{answer(b)(i)}(\times 100)$ gains **1** mark	2
2(b)(iii)	3.2	correct answer with or without working = **1** mark allow (ecf) 4 x ((b)(ii)/100) for **1** mark if correctly calculated	1

Question 2 continues on the next page

Question 2 continued

question	answers	extra information	mark
2(c)(i)	3.3	accept 3.33…….. or $3\frac{1}{3}$ or 3.3$\dot{}$ or 3.3^{r}	1
2(c)(ii)	measure to more decimal places **or** use a more sensitive balance / apparatus	allow use smaller scale (division) **or** use a smaller unit ignore accurate / repeat	1
2(c)(iii)	any **two** from: • different balances used **or** faulty balance • reading / using the balance incorrectly **or** recording error • spilling copper oxide / copper • copper oxide impure • not all of the copper oxide was reduced / converted to copper **or** not enough / different amounts of methane used • heated for different times • heated at different temperatures • some of the copper made is oxidised / forms copper oxide • some of the copper oxide / copper blown out / escapes (from tube) • some water still in the test tube	ignore systematic / human / apparatus / zero / measurement / random / weighing / reading errors unless qualified ignore dirty apparatus accept incorrect weighing of copper / copper oxide allow some copper left in tube allow impure copper (produced) accept not all copper oxide (fully) reacted accept Bunsen burner / flame at different temperatures ignore some copper oxide / copper lost	2
Total			**10**

4.3.1.4 Chemical measurements

Answer 06 · Mark scheme

June 2011 | CHY2H | Original Q2 | Legacy

CHY2H

4.3.1.4 Chemical measurements

Answer 07 · Mark scheme

June 2014 | CH1HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
5(a)	(thermal) decomposition	accept limestone decomposes allow endothermic	1	1 / 1.2.1b	E
	(to produce) calcium oxide / *CaO* **or** *quicklime*	accept a correct word or chemical equation for the last two marking points	1		
	(to produce) carbon dioxide / CO_2		1		
5(b)(i)	1.8(g)	*accept correct answer with or without working* accept $1.8 + 1.9 + 1.7 \div 3$ for **1** mark if no other mark awarded allow **1** mark for 1.6(g) or any calculation with one error	2	2 + 3 / 1.2.1b	E
5(b)(ii)	the limestone was not pure (calcium carbonate) **or** *contained impurities*		1	2 + 3 / 1.2.1b	E
	so less carbon dioxide was produced		1		
	the temperature was not high enough	allow not heated for long enough	1		
	so the limestone / *calcium carbonate* did not fully decompose / *react*		1		
Total			9		

4.3.1.4 Chemical measurements

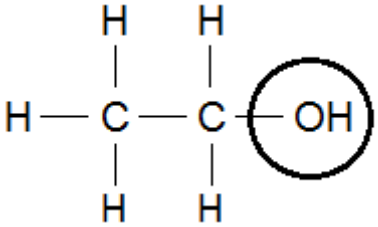
Answer 07 · Mark scheme

June 2014 | CH1HP | Original Q5 | Legacy



4.3.1.4 Chemical measurements

Answer 08 · Mark scheme June 2014 | CH3HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
2(a)(i)			1	1 / 3.6	G
2(a)(ii)	ethanol	*allow ethyl alcohol* *do **not** accept ethanal* *ignore all formulae*	1	1 / 3.3.1a	G
2(b)(i)	any **two** from: • lid • *metal* calorimeter • insulation (around sides of beaker) • excluding draughts • stirrer	 allow *metal* beaker do **not** allow flammable insulation / beaker *allow stirring*	2	3 / 3.3.1a	E

4.3.1.4 Chemical measurements

Answer 08 · Mark scheme

June 2014 | CH3HP | Original Q2 | Legacy

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th><th>ID</th></tr>
<tr><td colspan="4">2(b)(ii) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a ‘best-fit’ approach to the marking.
<table>
<tr><th>0 marks</th><th>Level 1 (1–2 marks)</th><th>Level 2 (3–4 marks)</th><th>Level 3 (5–6 marks)</th></tr>
<tr><td>No relevant content</td><td>There is a description of part of an experimental method or a measurement which should be taken.</td><td>There is a description of some parts of an experimental method and a measurement which should be taken.</td><td>There is a description of an experimental method and measurements which should be taken.</td></tr>
<tr><td colspan="4">Examples of the points that may be made in the response</td></tr>
<tr><td colspan="4">• light ethanol and heat water
• extinguish ethanol
• after suitable temperature rise or after a suitable time
• stir water
• measure mass / volume of water
• measure initial temperature of water
• measure final temperature of water
• measure temperature rise
• measure initial mass of ethanol (and burner)
• measure final mass of ethanol (and burner)
• measure change in mass of ethanol</td></tr>
</table></td><td></td><td>1 + 3 / 3.3.1a</td><td>E</td></tr>
<tr><td>Total</td><td></td><td></td><td>9</td><td></td><td></td></tr>
</table>

4.3.1.4 Chemical measurements

Answer 08 · Mark scheme

June 2014 | CH3HP | Original Q2 | Legacy



4.3.1.4 Chemical measurements

Answer 09 · Mark scheme June 2015 | CH1HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	(calcium) carbonate	ignore $CaCO_3$	1	1 / 1.2.1a
2(a)(ii)	(thermal) decomposition		1	1 / 1.2.1b
2(a)(iii)	water	allow H_2O allow hydrogen oxide	1	1 / 1.2.1d
2(a)(iv)	alkali	allow base	1	1 / 1.2.1d
2(b)(i)	straight line through the first, second and fourth points straight line through the last four points	 allow a straight line through the last three points if the first straight line extrapolates below point four	1 1	2+3 / 1.2.1g
2(b)(ii)	repeat the experiment (at each mass of aggregate) (use the results to) calculate a mean/average value (for each mass of aggregate)	do not allow repeat at other masses	1 1	3 / 1.2.1g

4.3.1.4 Chemical measurements

Answer 09 · Mark scheme

June 2015 | CH1HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(b)(iii)	line drawn to y axis showing extrapolation		1	2+3 / 1.2.1g
	correct value read from graph	allow +/- one small square do not allow 0 award 1 mark for a value of 34-40 if no extrapolation shown	1	
2(b)(iv)	at first, the force needed to break a concrete beam increases	allow values allow at first the statement is correct	1	3 / 1.2.1g
	but the force needed to break a concrete beam then decreases	allow values	1	
	mention of 400 g as the point at which the force needed changes or value from graph	allow 400g if there is no intercept on graph	1	
Total			13	

4.3.1.4 Chemical measurements

Answer 09 · Mark scheme

June 2015 | CH1HP | Original Q2 | Legacy



4.3.1.4 Chemical measurements

Answer 10 · Mark scheme June 2015 | CH3HP | Original Q8 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)(i)	any **one** from • incorrect measurement of temperature or volume • incorrect recording of temperature • failure to stir • heat loss	ignore faulty equipment	1	**AO3** 3.1.3.c
8(a)(ii)	32 - 33		1	**AO2** 3.1.3.c
8(a)(iii)	55		1	**AO2** 3.1.3.c
8(a)(iv)	20		1	**AO2** 3.1.3.c
8(a)(v)	4620 J / joules	allow 4.62 kJ for **2 marks** allow kJ if evidence of dividing by 1000 mark independently, but if a numerical answer has been divided by 1000 must be kJ. allow ecf from their answers to 8(a)(iii) and 8(a)(iv)	1 1	**AO2** 3.3.1.b/c
8(b)	twice as much energy released but twice as much water to heat	allow more energy released but more water to heat for **2 marks** if no other mark awarded, allow twice the amount of hydrochloric acid used for **1 mark**	1 1	**AO3** 3.3.1.c
Total			**8**	

4.3.1.4 Chemical measurements

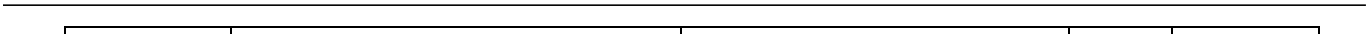
Answer 11 · Mark scheme June 2016 | CH2HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
1(a)(i)	5.75 **or** 5.8	correct answer with or without working gains **2** marks correct working showing addition of any four results and division by 4 gains **1** mark **OR** 6(.04) for **1** mark	2	AO2/AO3 2.5.1a,c
1(a)(ii)	use a polystyrene cup **or** lid to prevent energy/heat gain **OR** use a digital thermometer easier to read (to 0.1°C)	accept insulate the beaker accept to prevent energy/heat transfer do **not** accept energy/heat loss allow use a data logger	1 1	AO3 2.5.1a,c
1(b)	(as mass increases) the final temperature increases then stays constant correct reference to a value above 8 g up to and including 10 g as mass when the trend changes		1 1 1	2AO2 / 1AO3 2.5.1b
Total			**7**	

4.3.1.4 Chemical measurements

Answer 11 · Mark scheme

June 2016 | CH2HP | Original Q1 | Legacy



Answer 12 · Mark scheme

November 2020 | 8462/1H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	didn't stir (the solution enough)	allow measured the temperature before the temperature stopped falling allow measured the temperature too soon	1	AO3 4.5.1.1 RPA 4
09.2	the temperature decreases (initially) because energy is taken in (by the reaction from the solution)	allow temperature decreases (initially) because the reaction is endothermic	1	AO2 AO3 4.5.1.1 RPA 4
	when 1.5 g (of citric acid) is added the sodium hydrogencarbonate has all reacted **or** from 1.5 g the citric acid is in excess **or** when 1.5 g (of citric acid) is added the reaction is complete	allow when the temperature reaches 11.6 °C the sodium hydrogencarbonate has all reacted allow after the temperature reaches 11.6 °C the citric acid is in excess allow when the temperature reaches 11.6 °C the reaction is complete	1	
	(so) the temperature increases as energy is transferred from the room to the solution	allow (so) the temperature increases as energy is transferred from the excess citric acid to the solution	1	

Answer 12 · Mark scheme

Question 9 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	less steep line starting at 16.8 °C **and** reaching 1.00 g (of citric acid)	ignore any part of the line drawn beyond 1.00 g	1	AO3 4.2.2.8 4.5.1.1 RPA 4
	(as) metal is a better conductor	allow (as) polystyrene is a better insulator	1	
	(so) more energy is absorbed (from the surroundings)	allow (so) more heat is absorbed (from the surroundings)	1	
09.4	(M_r citric acid =) 192		1	AO2 4.3.2.5 4.3.4
	(moles = $\frac{250}{1000}$ × 0.0500) = 0.0125		1	
	(mass = 0.0125 × 192 =) 2.4 (g)	allow correct use of an incorrectly calculated M_r allow correct use of an incorrectly calculated number of moles	1	
	alternative approach:			
	(M_r citric acid =) 192 (1)			
	(concentration = 0.0500 × 192) = 9.6 (g/dm^3) (1)	allow correct use of an incorrectly calculated M_r		
	(mass = $\frac{250}{1000}$ × 9.6 =) 2.4 (g) (1)	allow correct use of an incorrectly calculated concentration in g/dm^3		

Question 9 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	add the citric acid (to the flask) until there is a (permanent) colour change	ignore colours of indicator	1	AO1 4.4.2.5 RPA 2
	measure / record the volume (of citric acid) added	allow take the final (and initial) burette reading	1	
	any **one** from: • swirl • use a white tile • add the citric acid dropwise (near the end-point) • repeat **and** calculate a mean	allow add the citric acid slowly (near the end-point)	1	
09.6	any **two** from: • can add (the citric acid) in small increments • can measure variable volumes • more accurate than a measuring cylinder	allow can add (the citric acid) drop by drop allow can add (the citric acid) slowly allow has a scale	2	AO1 4.4.2.5 RPA 2

Question 9 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7	(moles citric acid = $\frac{13.3}{1000}$ × 0.0500) = 0.000665		1	AO2 4.3.4 4.4.2.5 RPA 2
	(moles NaOH = 3 × 0.000665) = 0.001995	allow correct use of an incorrectly calculated number of moles of citric acid	1	
	(conc = $\frac{1000}{25}$ × 0.001995) = 0.0798 (mol/dm^3)	allow 0.08 or 0.080 (mol/dm^3) allow correct use of an incorrectly calculated number of moles of NaOH	1	
	alternative approach: $\frac{25.0 \times \text{conc NaOH}}{13.3 \times 0.0500} = \frac{3}{1}$ (1) (conc NaOH =) 3 × $\frac{13.3 \times 0.0500}{25.0}$ (1) = 0.0798 (mol/dm^3) (1)	allow $\frac{13.3 \times 0.0500}{25.0 \times \text{conc NaOH}} = \frac{1}{3}$ allow 0.08 or 0.080 (mol/dm^3)		

Total			18

4.3.1.4 Chemical measurements

Answer 13 · Mark scheme

June 2023 | 8462/2H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	to reduce the escape of gas		1	AO3 4.6.1.1 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	(mean rate =) $\frac{0.78 + 0.81 + 0.81}{3}$	allow $\frac{0.78 + 0.81 + 0.68 + 0.81}{4}$	1	AO3
	0.80 (cm^3/s)	= 0.77 (cm^3/ s) for **1** mark	1	AO2
	$0.80 = \frac{20}{\text{mean time taken}}$	allow correct use of incorrectly determined mean rate	1	AO2
	(mean time taken =) $\frac{20}{0.80}$		1	AO2
	= 25 (s)		1	AO2 4.6.1.1 RPA5
	alternative approach: $0.78 = \frac{20}{\text{time}}$ **or** $0.81 = \frac{20}{\text{time}}$ (1)			
	(trial 1 time = $\frac{20}{0.78}$ =) 25.6 (1)			
	(trial 2 and 4 time = $\frac{20}{0.81}$ =) 24.7 (1)			

	(mean time =) $\frac{25.6 + (2 \times 24.7)}{3}$ (1) = 25 (s) (1)	allow correct use of incorrectly determined value(s) for time allow $\frac{25.6 + 29.4 + (2 \times 24.7)}{4}$ = 26.1 (s) for **1** mark		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	use a lower temperature use sulfuric acid of a lower concentration		1 1	AO1 4.6.1.2 RPA5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	(test) burning / lit splint (result) burns with a (squeaky) pop sound	MP2 is dependent upon MP1 being awarded allow flame do **not** accept glowing splint allow pops	 1 1	AO1 4.8.2.1

Total Question 1	10

4.3.1.4 Chemical measurements

Answer 14 · Mark scheme

June 2024 | 8462/1H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	line of best fit using the first five points line of best fit using the last four points	max **1** mark if the lines do not intersect	1 1	AO3 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	the temperature rises because the reaction is exothermic **or** the temperature rises because energy is transferred to the surroundings	allow heat for energy	1	AO2
	until 0.8 g (zinc) is added	allow a tolerance of ± ½ a small square allow until the temperature reaches 47 °C allow a correctly determined value for mass of zinc or temperature from the intersection of drawn lines of best fit	1	AO2
	(so) there is no additional reaction	allow (when) the reaction has finished	1	AO3
	(because) zinc is in excess **or** (because) copper sulfate is used up		1	AO3 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	polystyrene is a better (thermal) insulator (so) there is less energy transfer to the surroundings	allow converse statements for glass allow (so) less energy is lost (to the surroundings) allow heat for energy	1 1	AO1 4.5.1.1 RPA4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$ allow **1** mark for $Zn^{2+} + Cu$		2	AO2 4.1.1.1 4.2.2.2 4.4.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	(mean highest temperature =) $\frac{37.6 + 37.2 + 37.8 + 37.4}{4}$ = 37.5 (°C) 37.5 (°C) ± 0.3 (°C)	allow (mean highest temperature =) $\frac{150}{4}$	1 1 1	AO2 4.3.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	any **one** from: • starting temperature may be different • inconsistent stirring	ignore room temperature allow inconsistent use of a lid	1	AO3 4.5.1.1 RPA4

Total Question 4	14

4.3.1.4 Chemical measurements

Answer 15 · Mark scheme

June 2025 | 8462/2H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	(a burette is) more accurate (than a measuring cylinder)	allow (a burette has) a higher resolution ignore precise	1	AO3 4.10.1.2 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	the mass of (dissolved) solids		1	AO1 4.10.1.2 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	reheat (the evaporating basin and contents) (and reweigh) until constant mass	 allow for **2** marks heat to constant mass	1 1	AO3 4.10.1.2 RPA8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	subtract the mass of the (empty) evaporating basin from the mass of the evaporating basin and contents (at the end of the experiment)	allow subtract initial mass from the final mass	1	AO1 4.10.1.2 RPA8

4.3.1.4 Chemical measurements

Answer 15 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	(allow mean mass =) $\frac{0.35 + 0.37 + 0.33 + 0.34}{4}$	(allow mean mass =) $\frac{1.39}{4}$	1	AO2 4.3.2.5 4.10.1.2 RPA8
	= 0.3475 (g)		1	
	(conversion 10 cm^3 =) 0.01 dm^3		1	
	(mean concentration =) $\frac{0.3475}{0.01}$	allow correct use of incorrectly determined mean mass allow correct use of incorrect / no conversion of volume	1	
	= 34.75 (g/dm^3)	allow 34.75 (g/dm^3) correctly rounded to at least 2 significant figures	1	
	alternative approach 1 (conversion 10 cm^3 =) 0.01 dm^3 (1)			
	(concentrations =) $\frac{0.35}{0.01}$ $\frac{0.37}{0.01}$ $\frac{0.33}{0.01}$ $\frac{0.34}{0.01}$ (1)	allow correct use of incorrect / no conversion of volume		
	= 35 37 33 34 (1)			
	(mean concentration =) $\frac{35 + 37 + 33 + 34}{4}$ (1)	(allow mean concentration =) $\frac{139}{4}$ allow correct use of incorrectly determined concentrations		
	= 34.75 (g/dm^3) (1)	allow 34.75 (g/dm^3) correctly rounded to at least 2 significant figures		

	alternative approach 2 using total mass and total volume (total mass = 0.35 + 0.37 + 0.33 + 0.34 =) 1.39 (g) (1) (total volume = 10 + 10 + 10 + 10 =) 40 cm^3 (1) (conversion 40 cm^3 =) 0.04 dm^3 (1) (mean concentration =) $\frac{1.39}{0.04}$ (1) = 34.75 (g/dm^3) (1)	 allow correct use of incorrectly determined total mass allow correct use of incorrect / no conversion of total volume allow 34.75 (g/dm^3) correctly rounded to at least 2 significant figures		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	the samples were taken from different places		1	AO3 4.10.1.2

Total Question 1	**11**

Answer 12 · Examiner comments

November 2020 | 8462/1H | Original Q9

Question 9 (standard, standard / high and high demand)

09.1 A third of students scored this mark; some realised that the most likely error was lack of stirring; fewer suggested that the temperature was measured too early, before the temperature had stopped falling. Many suggestions contradicted the information given.

09.2 Students had great difficulty in expressing their answers using correct terminology, often using energy and temperature interchangeably. They generally find endothermic reactions difficult; they do not seem to realise that the energy taken in is not staying as thermal energy but is being converted to chemical energy. Some students gained the mark for saying that the temperature initially falls because energy is being taken in, showing an endothermic reaction. A few noted that when 1.5 g of citric acid had been added the reaction had finished and that the citric acid was in excess from there on. However, it was very rare for a correct explanation for the subsequent rise in temperature to be given. Some thought the reaction suddenly became exothermic, or that it suddenly reversed (showing a lack of understanding of reversible reactions).

09.3 Many students realised that the difference was due to the better thermal conductivity of the metal. However, many of those merely referred to the metal as a good conductor, without comparing the metal to polystyrene. The majority of students drew a steeper line, stating that the metal would lose heat more quickly. Of those who drew the correct shallower line, few could explain that the metal would conduct thermal energy in from the surroundings more quickly, reducing the temperature drop in this endothermic reaction.

09.4 Many students were able to score all three marks. Common errors were to confuse concentration with number of moles and to fail to convert 250 cm^3 to 0.25 dm^3 correctly. The symbol ‘m’ for number of moles was commonly seen instead of ‘n’ – students consequently became confused between mass and number of moles. Students who set out their working step by step were able to gain partial credit, but those who simply had a jumble of numbers, with no explanation as to what the numbers represented, were not.

09.5 Most students scored at least two marks Some students referred to ‘amount’ of acid added rather than volume, and many failed to take any burette readings at all. It was not uncommon to see a conical flask placed ‘under’ a white tile rather than on one.

09.6 This was not well answered. Most students who scored a mark did so for stating that the acid could be added drop by drop, or that the rate of flow could be controlled. Few stated that the burette could measure variable volumes (unlike a pipette). Many stated that a burette was ‘more accurate’ but did not say what they were comparing it to. Of those who

Answer 12 · Examiner comments November 2020 | 8462/1H | Original Q9

did, most said it was more accurate than a pipette, which is not true. Some students confused a volumetric pipette with a dropping pipette.

09.7 This titration calculation was well done by many students. To gain full credit, working needed to be correct as well as the final answer. Students therefore need to show their working step by step in a way that can be followed by the examiner. Common errors were to omit to convert volumes to dm^3, to attempt to do so but incorrectly, or to omit the mole ratio of citric acid to sodium hydroxide. As with question 09.4, students who incorrectly used the symbol 'm' to mean moles often confused themselves; they should be encouraged to use 'm' only for mass, and 'n' for number of moles.

4.3.1.4 Chemical measurements

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.3.1.4 Chemical measurements

Answer 13 · Examiner comments

June 2023 | 8462/2H | Original Q1

Question 1 (standard demand)

01.1 Fewer than a quarter of students scored a mark here, with most suggesting incorrectly that no gas at all would escape. The idea of minimising escape was key to gaining the mark.

01.2 The vast majority of students used the main approach on the mark scheme. Around three-quarters of students scored all the marks. Of those who didn't, the majority scored 4 marks by failing to discard the anomalous result in MP1. Weaker responses typically calculated the mean rate of 0.80 cm^3/s but were able to take the process further and gained two marks.

01.3 This closed question was answered completely correctly by two-thirds of students, whilst more than 80% scored one mark. Of these, there was usually a conflict between a factor which would speed the reaction up and one which would slow it down.

01.4 Around three-quarters of the students gained both marks. Uncreditworthy responses usually included the squeaky pop test as a description of the test without reference to flames or burning splints, or described the use of a glowing splint.

Answer 14 · Examiner comments

Question 4 (standard and standard/high demand)

04.1 Just over two fifths of students correctly drew two straight lines, with the ascending line having an even scatter either side of the points, and the horizontal line avoiding the anomaly. Some lines were doubled or feathered so did not gain credit. Some drew two different curves, each encompassing all the points, and made them cross somewhere. This gained no credit. Students should be aware of the sort of graph produced by this required practical.

04.2 This question discriminated well, with a quarter of students scoring 3 or 4 marks and the great majority scoring at least one mark. The question asked students to explain the results, but many simply described them. It was not sufficient just to describe the temperature increasing with the addition of more zinc; reference to the reaction being exothermic was also needed. The fact that the maximum temperature change occurred when 0.80 g of zinc was added was the mark scored most often, but many students were also able to explain this turning point in terms of no further reaction being possible because the zinc was now in excess. There were some excellent answers in terms of the zinc being the limiting reactant up to 0.8 g, after which the copper sulfate became the limiting reactant.

04.3 Some excellent answers were seen; however, fewer than a quarter of students scored both marks and only three fifths scored at all. The question asked why a polystyrene cup gives a more accurate result, so answers needed to be phrased in comparative terms. Polystyrene is a better insulator than glass, but it is not true that polystyrene is 'an insulator' and glass is 'a conductor,' since both materials insulate and conduct thermal energy to different extents. Similarly, many answers implied that no energy is lost from a polystyrene cup, which is not true.

04.4 Nearly two fifths of students were able to give the correct formulae of the products but the state symbols were sometimes incorrect. A common incorrect formula was Zn^{2-}. There was sometimes no clear distinction between upper and lower case letters; the n and u need to be discernibly smaller than the Z and the C. Many students tried to give formulae of compounds rather than just the ion or atom.

04.5 The vast majority of students were able to calculate the mean. Fewer than half were also able to express the mean and the uncertainty correctly. Some students only averaged the highest and lowest values, which calculates the median rather than the mean. Although the mean and the median are the same in this particular set of values, this method did not gain credit. Some students calculated the uncertainty by halving the range. This calculates the range about the median, rather than the definition in the specification which is the range about the mean. This method was given credit on this occasion, although it is not strictly correct.

04.6 Students found this question difficult, with fewer than a quarter scoring the mark. Despite the information that there were no measurement errors, many students gave a type of measurement error as their answer. Reading the method carefully would have pointed out that the starting temperature was neither measured nor controlled, so may have fluctuated, and that stirring is inherently inconsistent. Some students had evidently done the practical using a lid and referred to it being replaced at different times; this was given credit.

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Answer 15 · Examiner comments

Question 1

01.1 Two thirds of students gained this marking point. Common incorrect responses included accurate (no comparative), more precise, easier to use and less likely to spill.

01.2 This mark was gained by three quarters of students. the most common errors were the volume of sea water and not mentioning mass.

01.3 The idea of heating to constant mass was known by a quarter of students, who gained two marks. Nearly 3 in 5 students gained no marks, often suggesting heating for longer, looking at the basin to see if there was any water left, heating above 100°C or patting dry.

01.4 Three fifths of students expressed the correct method of calculating the mass of dissolved solids. Those that did not gain this mark often missed the use of a mass or just suggested using a weighing scale.

01.5 Over half of students scored all five marks on this calculation. Where all five marks were not achieved, the most common error was an incorrect or no conversion from cm^3 to dm^3.

01.6 Half of students were able to suggest that the samples had come from different areas of the sea. Those that did not gain the mark tended to just reword the question.